OPAL ROAD ALTERNATIVE ANALYSIS

Prepared for:

City of Bentonville, Arkansas

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Olsson Project No. 021-04210-H

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SW Regional Airport Biv

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Introduction & Objective

SW Opal Road is a collector roadway located in the southwest portion of the City of Bentonville, Arkansas. Opal Road is depicted on the City of Bentonville Master Street Plan for proposed widening to three-lanes with sidewalks, drainage, bridge replacement, and intersection improvements. The study corridor extends east then north along SW Opal Road between SW Adams Road and SW Rainbow Farm Road. The project area is illustrated on the vicinity map, Figure 1.

The objective of this report is to present and summarize the improvements and alignment alternatives to allow the City to make an educated decision on the preferred alignment that can be carried forward into preliminary design. The preferred alignment will meet or exceed the standards and requirements of the City of Bentonville and the American Association of State Highway Officials (AASHTO).

Included at the end of this report are:

- Vicinity Map, Figure 1
- Detailed Design Criteria, Figure 2
- Roadway and Bridge Typical Sections, Figure 3
- Concepts, Figure 4
- Cost Estimates, Figure 5
- HEC-RAS Results, Figure 6

Based on preliminary meetings with the City of Bentonville, it is our understanding that the primary goal of the project is to create a safe east-west street crossing over the Little Osage Creek and Little Osage Creek Tributary 2 floodplain. The growing area to the west includes new subdivisions and a new elementary school opening in the fall of 2022. A crossing of these floodplains in this area has been difficult and has been precluded by the Osage Hills subdivision and SW Anglin Road to the west of Little Osage Creek. Anglin Road was intended to connect with Rainbow Farm Road as an arterial according to the City of Bentonville's Master Street Plan.

To achieve the goal of an improved and safe crossing of these floodplains, the City had envisioned upgrading Opal Road and re-alignment with Vendor Boulevard to create a continuous east-west connection. The existing north to south portion of Opal Road would then connect to the new alignment as a side street connection. While Vendor Boulevard is currently not a collector, the City has indicated that when the area adjacent to Vendor Boulevard becomes developed, it can be upgraded to collector status.

Description of Alternatives

The scope of this concept design study included development and review of four alignment alternatives for the project improvements. The alternatives identified were evaluated based on wetland impacts, stream channel impacts, bridge considerations, property impacts, access during construction, potential for future roadway extensions and estimated construction costs. Utility impacts were considered with each alternative but were essentially the same in each iteration. There is an overhead power distribution line along the north side of Opal Road that would be in conflict with all four alternatives in some form due to roadway re-alignment. The overhead power transmission line was found to only be in conflict with one alternative (Alternative 3) and will be discussed below. The existing sanitary sewer was found not to be in conflict with the alternatives due to the amount of fill that would be required to raise Opal Road out of the floodplain.

With Opal Road planned to be classified as a future collector, the criteria detailed in the City of Bentonville's Master Street Plan was followed. Each alternative for Opal Road uses a 35-mph design speed for both horizontal and vertical alignments. Detailed design criteria are included as **Figure 2**.

On all the alternatives, the roadway typical section consists of a 37-foot urban roadway section with 7foot green space back of curb. A 5-foot sidewalk and a 12-foot sidewalk will be on opposite sides of the roadway outside of the 7-foot green space. The location of each of the sidewalks will be discussed in each of the alternatives below. Outside of these sidewalk areas will be a 1-foot shoulder before a 3:1 maximum slope to tie into existing ground. For more information, the roadway and bridge typical sections are included as **Figure 3**.

The conceptual alternatives include:

<u>Alternative 1</u> – A new alignment of SW Opal Road that features reverse horizontal curves connecting Opal Road to Vendor Boulevard across the floodplain. The horizontal curves would have a minimum of 100-feet between them per the City's roadway design standards. While this alternative would create the desired connection with Vendor Boulevard per the City's objective, most of the roadway would be located in the floodplain requiring significant grading to raise the profile out of the flood elevation as well as constructing a cost prohibitive bridge structure to cross the floodplain and both channels, the Little Osage Creek and Little Osage Creek Tributary 2. This bridge would most likely have to span the width of the floodplain to create a no-rise in the floodplain due to the raising of the profile and the associated grading.

The 12-foot sidewalk would be located on the south side of this alternative and then cross Vendor Boulevard at the intersection with Opal Road. This 12-foot sidewalk would then either follow the north leg of Opal Road on the east side or follow Vendor Boulevard on the north side of the roadway. The 12foot sidewalk would be better positioned on the north side of Vendor Boulevard due to the proximity of the existing roadway to the Wal-Mart distribution center as there would not be enough space between the back of curb and the fence to the property to allow for this sidewalk.

During a meeting with the City of Bentonville, it was determined that this alternative could be eliminated from any further study due to the reasons outlined in the previous paragraphs. This alternative is still included in this report for information purposes only. <u>Alternative 2</u> – A new alignment of SW Opal Road that features a single horizontal curve connecting Opal Road from the west to Vendor Boulevard. The section of Opal Road to the north would remain in the floodplain and connect as a T-intersection to the new Opal to Vendor alignment. This alternative would keep the City's desired connection to Vendor Boulevard but would also require a bridge structure and some raising of the profile to cross the floodplain. However, this alignment crosses less of the floodplain than that of Alternative 1.

For pedestrian connectivity, the 5-foot sidewalk would parallel Opal Road to the north of the alignment, while the 12-foot sidewalk would be located to the south of the roadway. The 12-foot sidewalk would cross to the north side at the new Opal Road and Vendor Boulevard intersection like Alternative 1. The 12-foot sidewalk would continue along the north side of Vendor Boulevard due to the proximity of the Wal-Mart distribution center as described in Alternative 1.

One of the biggest challenges with this alternative would be the driveway connection to the two homes south of the Opal/Vendor intersection. This drive would have to be realigned to tie into an area away from the bridge structure and may require some retaining walls to reduce the grading to the Wal-Mart distribution center that is adjacent to the project.

Additional consideration should be given to the reconstruction of Vendor Boulevard to collector status to the connection with SW Regional Airport Boulevard. While new development may occur along the north side of Vendor Boulevard, the area to the east of Villa Street is already built out and presents challenges on allowing Vendor Boulevard to meet classification standards regarding horizontal geometry. The existing reverse curves between Villa Street and SW Runway Drive would need to be corrected for a higher design speed. With an expected increase in traffic along the new collector route on Vendor Boulevard, a traffic signal may likely be warranted to be installed at SW Regional Airport Boulevard. However, because SW Regional Airport Boulevard is a state highway, any warranted signal would not meet ARDOT requirements for signal spacing if the SW Rainbow Farm Road intersection to the north is signalized. The costs of these improvements should be considered if this alternative is to be properly evaluated.

<u>Alternative 3</u> – This alternative is similar Alternative 2 where a horizontal curve would be utilized to connect the east to west portion of Opal Road to the north to south portion. This alternative was considered as it was consistent with the City's Master Street Plan that shows Opal Road (both east/west and north/south) as the collector rather than including the existing portion of Vendor Boulevard. The difference from Alternative 2 would be the curve would be shifted slightly south to attempt to cross the channel to the south of the confluence of the Little Osage Creek and Little Osage Creek Tributary 2. When laying out this alternative, the horizontal curve radius for the design speed of 35 mph would not meet the desired value and would require some superelevation which is not desirable on urban streets nor on bridges. Not only would a bridge be constructed but retaining walls would also need to be constructed due to the proximity to the adjacent Wal-Mart distribution center. This alternative was also the only alternative that impacted the overhead transmission line that runs north and south in the project area that would add significant cost to the project.

The 12-foot sidewalk in this alternative would be intended to remain on the south side of Opal Road and continue along the east side as the alignment turns north. A 12-foot sidewalk would not be proposed to run parallel along Vendor Boulevard in this concept.

Since this alternative would fail to meet the City's design criteria in several areas, as well as not making Vendor Boulevard the intended collector movement, Alternative 3 was eliminated from consideration, but documented for information only.

<u>Alternative 4</u> – This is a new alignment of SW Opal Road that would connect towards SW Rainbow Farm Road to the north via reverse curves to the west of the existing floodplain and crossing only the Little Osage Creek. This alternative would move Opal Road completely out of the floodplain to the west of both channels. This alternative would also better provide connectivity to recent developments to the west of the City of Bentonville, especially to the new Osage Hills development directly to the northwest of the project boundary.

In this alternative, the 12-foot sidewalk is shown along the south and east side of the new Opal Road alignment for the entire length of the concept. This side was chosen to provide future connections to the City of Bentonville's trail network. The location of the 12-foot sidewalk in this alternative may be re-evaluated during design if this alternative is selected as there is more potential for residential connections on the west and north of this new alignment.

While this would remove this portion of Opal Road from the floodplain, the section of SW Rainbow Farm Road to the north and east of this connection would remain in the floodplain of the Little Osage Creek Tributary 2 and would have to be evaluated as well. The estimated costs of these additional improvements will be evaluated and added to this report similar to the cost evaluation of upgrading Vendor Boulevard with Alternative 2.

A challenge of this alternative would be that property acquisition as this alternative would split up developable ground and the final alignment would have to account for allowances for development on both sides of the new Opal Road. While this may be seen as a challenge as the amount of acquisition would come from a single property owner, the future roadway would provide additional benefit and value to the land for development purposes. As the future roadway would provide direct access to both sides of the roadway, this makes the land more attractive and provides a section of roadway a developer would not have to construct. This should be seen as a benefit to both the landowner and to the City of Bentonville despite the challenges that may come with acquisition.

Concept plans for Alternatives 1, 2, 3, and 4 are included as Figure 4.

Key elements considered in the development of the general layout of the alignment alternatives include:

- Property impacts
- Wetland impacts
- Stream channel impacts
- Bridge considerations
- Access during construction
- Future roadway extensions
- Quantities and estimated costs

Property Impacts

The acquisition of Right-of-Way (permanent right-of-way, permanent easements, and temporary easements) will be required along the entire length of the project for all four alternatives. According to the City of Bentonville's Standard Street Specifications, proposed right-of-way width for a collector classified roadway is 70-feet. Opal Road currently does not have a specified right-of-way width in the project area according to research into property information.

A minimum of 70-feet width is proposed for the length of the proposed roadway improvements. Any public streets that connect to Opal Road or to the Opal/Vendor connection will dedicate a minimum 50-feet of right-of-way per the Standard Street Specifications for local streets. Easement areas included in the table below are calculated based on conceptual models of the proposed alternatives.

The following table outlines the preliminary right-of-way needs associated with each alternative.

	Right-of-Way Square Footage					
Alternative	Permanent ROW	Easements	Total			
Alternative 1	Alternative not assessed					
Alternative 2	114,000	108,000	222,000			
Alternative 3	Alternative not assessed					
Alternative 4	217,000	92,000	309,000			

Note: The areas shown in this table are based on the concept layouts and are to be used for only for comparison purposes of the alternatives. No right-of-way costs are included.

Wetland Impacts

Based on a field delineation of Waters of the United States, it was determined that no wetlands are located within the project areas for Alternative 2 and Alternative 4. The project areas for Alternative 1 and Alternative 3 were not assessed during the field delineation.

Stream Channel Impacts

The linear feet and acreage of channel impacts were estimated using the field delineation of the ordinary high water mark for each of the waterbodies located within the project areas for Alternative 2 and Alternative 4. The project areas for Alternative 1 and Alternative 3 were not assessed during the field delineation. The following table summarizes the total channel impacts associated with each alternative:

Alternative	Total Channel Impacts (linear)	Total Channel Impacts (area)
Alternative 1	Alternative not assessed	Alternative not assessed
Alternative 2	695 linear feet	0.43 acre
Alternative 3	Alternative not assessed	Alternative not assessed
Alternative 4	569 linear feet	0.38 acre

Clean Water Act Compliance and Section 404 Permitting

Alternatives 2 and 4 would both be covered by Nationwide Permit 14 for Linear Transportation Projects due to the impacts within the ordinary high water mark (OHWM) being less than 0.5-acre. Any impacts within the OHWM greater than 0.1-acre would require mitigation in the form of purchasing credits from an approved mitigation bank that services the project's location.

Bridge Considerations

This project is primarily a bridge project and the goal is to provide a safe vehicular and pedestrian crossing over Little Osage Creek and Little Osage Tributary #2 and promote east-west thoroughfare traffic on Opal Road.

Little Osage Creek is in a Zone A FEMA regulated floodplain where base flood elevations have not been determined. Little Osage Creek Tributary #2 is in Zone AE, where a mapped floodway and elevation are in place. Due to the fact that Opal Road will be crossing a mapped floodway, an appropriate floodplain development permit and a no-rise (or map revision) are required.

The existing roadway exists immediately south of the confluence of these two streams, which routinely overtops the southern culvert on Opal Road and the low water crossing immediately north of the intersection with Vendor Road.



Figure A: FEMA Flood Insurance Rate Map (Map #05007C0235K)

It is understood after speaking with City staff members that the new bridge(s) should be configured to span the 100-year base flood elevation with 1-foot of freeboard. This criteria is conservative and exceeds the city and state's standard hydraulic design criteria. However, since this project consists of a substantial improvement over the existing conditions, where significant fill will be placed within the edges of the floodplain fringe, it is a cost-effective strategy to simply span the base flood elevations to minimize right of way and permitting requirements.

We suggest reducing the roadway section at the bridge location(s) to eliminate the turn lane and simply provide a 26-foot-wide roadway plus 5-foot and 12-foot sidewalks. Concrete jersey shape barriers with a handrail would separate the roadway from the pedestrians, and a short curb and pedestrian fence would be situated at the edges of the bridge. The anticipated bridge would be 47'-10", measured out-to-out of deck. It will be critical to minimize the superelevation or breakover the deck to ensure that the sidewalks meet ADA cross-slope requirements.

A preliminary H&H model in HEC-RAS was prepared for each of the two viable alternatives (Alternatives 2 and 4) to estimate the size of the required bridge openings that enable the project to meet the hydraulic design criteria. This model enabled our designers to anticipate grading and right of way impacts, predict the required profile raise needed for the roadway, and identify viable bridge structure types and span configurations. Olsson received a HEC-RAS model of Little Osage Creek Tributary II from FEMA through a data request. Olsson updated the model with surveyed cross sections in the channel near Opal Road bridge to analyze existing conditions and then proposed conditions with the proposed bridges along Little Osage Creek Tributary II for Alternatives 2 and 4. FEMA didn't provide a model of Little Osage Creek, so an existing conditions model was created based on LiDAR contours, aerials, and FIS flows. Olsson then added the proposed bridge.

• For Alternative 2, the upstream water surface elevation was determined to be 1181.52 feet (100-year), which is a no-rise in the base flood elevation, and 1-foot of freeboard can be ensured with a single, 275-foot long bridge. The optimal roadway profile utilizes a crest vertical curve on the bridge with the VPI at elevation 1187.35. The flowline of the stream is at approximately 1169', so the bridge is approximately 18 feet tall. To achieve no-rise upstream of the bridge and 1-foot of freeboard, the channel and overbanks will need to be graded approximately 150' upstream and downstream of the bridge to increase conveyance and realign the channel under the bridge to limit scour under the bridge. Despite the no-rise upstream of the bridge, there was a minor rise downstream of the bridge. Once full survey is completed, Olsson will be able to update the model and look at adjusting grading to potentially achieve a true no-rise. If a no-rise cannot be achieved, a CLOMR and LOMR will be needed to update floodplain and floodway mapping.

Due to the necessary alignment of the roadway and existing stream corridor, this location places the bridge in the middle of a 510' radius curve. We recommend utilizing a three-span, steel rolled beam bridge with a conventional concrete deck. The anticipated span arrangement would be approximately 80'-115'-80', and the spans may be optimized with the fine grading of the spill/fills under the bridge in the preliminary design phase. We suggest following ArDOT standards, utilize weathering steel girders, and integral bent construction techniques with approach slabs. Integral construction techniques allow the bridge's expansion joints to be accommodated off the structure, which minimizes the source of substantial future maintenance costs.

Depending on the findings of the geotechnical investigation, intermediate bents supported on steel piles may be effectively utilized at this bridge height. If bedrock is deep, then concrete columns on appropriate foundation elements (drilled shafts/pile supported footings, etc) may be warranted.

• For Alternative 4, the upstream water surface elevation was determined to be 1186.61 at the southern bridge on Opal Road and 1193.74 at the northern bridge on SW Rainbow Farm Road. The southern bridge would cross only the Little Osage Creek and the northern bridge would cross the Little Osage Tributary II as part of this project or built later as a future project. This alternative, while requiring significant new additional right-of-way, provides substantial benefit in minimizing the amount of fill placed within the stream corridor (minimizing permitting requirements), enables much simpler (and cheaper) structures to be built in tangent sections of roadway by avoiding a challenging geometric reconciliation with Vendor Road at or otherwise near the confluence of two streams.

The southern bridge that would carry the new alignment of Opal Road over the Little Osage Creek is configured as a 125-foot long, single span bridge at a 2.0% constant grade. The preliminary hydraulic model with this bridge opening was able to ensure a no-rise and 1-foot of freeboard to the 100-year storm. To achieve no-rise upstream of the bridge and 1-foot of freeboard, the overbanks will need to be graded approximately 200' upstream and 150' downstream of the bridge to increase conveyance. Despite our conceptual model providing a no-rise, once survey data is provided a no-rise might not be achieved. If a no-rise cannot be achieved, a CLOMR and LOMR will be needed to update the floodplain and floodway.

The southern bridge span length is easily obtainable with a single span prestressed concrete NU43 girder or utilization of weathering steel rolled beams. Steel solutions would be improved by efficient use of cover plate techniques to keep weight to a minimum. Unit costs shown below are based on average unit costs that ArDOT publishes annually. We intend to complete a thorough evaluation of bid tab history from the state to configure the most cost-effective girder type during preliminary design.

The northern bridge would consist of an improvement of the SW Rainbow Farm Road crossing over Tributary II, such that it would afford the same hydraulic design performance and reliability as the rest of Opal Road. Similarly to the southern bridge on Opal, the west end of the bridge is fairly low-lying in the floodplain and the road/bridge would be constructed at a constant grade of approximately 1%. The primary channel is roughly 35-feet wide at this location and has a mapped floodway. As such, we intend to utilize a 200-foot long, three-span bridge with spans that are approximately 60'-85'-55'. A weathering steel, steel rolled beam bridge is likely to be the most cost-effective structure type at this location. To achieve no-rise upstream of the bridge and 1-foot of freeboard, the overbanks will need to be graded approximately 150' upstream and 250' downstream of the bridge to increase conveyance. Despite our conceptual model providing a no-rise, once survey data is provided a no-rise might not be achieved. If a no-rise cannot be achieved, a CLOMR and LOMR will be needed to update the floodplain and floodway.

Utilizing a single span bridge at the southern location and three-span bridge at the northern location minimizes future maintenance associated with the stream crossing, simplifies and streamlines bridge construction (tangent, constant grade, normal crowns), minimizes

environmental and FEMA permitting requirements, and provides a reliable pair of crossings that can be constructed sequentially at the same anticipated bridge cost for what would otherwise be necessary to build in Alternative #2.

Alternative	Length	Skew	Square Footage	Estimated Unit Cost (2022)	Estimated Construction Cost
Alternative 1	Alternative not assessed				
Alternative 2	275 feet	Horizontally Curved, Bents skewed radially to curve	13,155 sf	\$225/sf	\$3.0M
Alternative 3	Alternative not assessed				
Alternative 4	125 feet (south crossing on new Opal Alignment)	Tangent and no skew	5,980 sf	\$165/sf	\$1.0M

Note: Estimated bridge costs in this table do not include abutments or channel grading. See Figure 5 for more details.

After a preferred alternative is selected and during preliminary design the hydraulic model will be refined, and the bridge type, size and location analysis completed.

Constructability & Access During Construction

All four alternatives allow for most of the construction to take place while traffic is maintained along existing Opal Road. Staged construction will be required to complete the intersection improvements at Vendor Boulevard and to complete the connections to the existing Opal Road at the West and North ends of the improvement. Temporary driveway connections to properties will be maintained at all times during construction as required to maintain access to residents.

In comparing Alternatives 2 and 4, Alternative 2 would require access during construction to the residences to the south of Opal Road where Opal turns toward the north as this connection will have to be reconstructed. In Alternative 4, these properties would be able to have their access remain as it does today as they use the Vendor Boulevard intersection as this area would not be disturbed in this alternative. Alternative 4 would provide the least amount of direct access or temporary access conflicts during construction.

Future Roadway Extensions

When looking at both Alternative 2 and Alternative 4, these alternatives would require some improvements to the east of the project area to connect into other collectors and/or arterials before providing benefit to westward expansions.

In Alternative 2, with the connection to Vendor Boulevard being the preferred route, Vendor would have to be upgraded to meet collector standards by increasing horizontal curvature radii in existing

curves which would require some re-alignment of the roadway. While the costs associated with this improvement may be levied towards the development of the property that is adjacent to the north side of Vendor Boulevard, this development may not occur in a timely manner leaving this section of Vendor below standards as specified by the City's Master Street Plan. Upgrading Vendor Boulevard and planning for additional traffic may increase the need for a traffic signal at the intersection of SW Regional Airport Boulevard (State Highway 12), which will not be possible per ARDOT requirements (i.e. ½ mile signal spacing) if a signal is also installed at the SW Rainbow Farm Road intersection. Despite the potential of the associated costs of expanding Vendor Boulevard being deferred to potential development, a highlevel cost estimate has been generated for these improvements for consideration along with Alternative 2.

In the case of Alternative 4, the remaining portions of the existing Opal Road and SW Rainbow Farm Road from this project's limit on Opal Road (as depicted in **Figure 4**) to the paved portion of SW Rainbow Farm Road would need to be improved to provide a connection to an existing collector system to the east. This extension would require at least one bridge structure to be constructed over the east branch of the Little Osage Creek Tributary 2 near the Opal Road/Rainbow Farm Road intersection. As this area near the channel is in the existing floodplain, considerations would have to be accounted for in raising the roadway elevation out of the floodplain to prevent overtopping events. A high-level cost estimate has been prepared for this connection of Opal Road to SW Rainbow Farm Road to compare to the associated costs of Alternative 2.

With Alternative 4's proximity to the current Osage Hills residential development directly northwest of the project limits, Opal Road could provide a connection to SW Bison Street providing a direct link to the development. This alternative would also provide developable parcels on both the east and west sides of the realigned Opal Road that could provide direct access and connectivity to the City's network of collectors and arterials. This alternative would immediately begin to serve the City's long-term goal of providing better connectivity to western developments by creating direct access to currently developing properties that stunted the SW Anglin Road corridor from being connected to SW Rainbow Farm Road.

Both Alternative 2 and Alternative 4 would connect to the existing portion of Opal Road at the western terminus of the project. Either alternative could then be extended to the west along the existing alignment to provide connectivity to future western developments. However, with westward expansion of Opal Road, some realignment of Opal Road would be required around Barron Cemetery which is located about 1,000 feet east of the intersection of Opal Road and SW Barron Road.

A summary of the conceptual costs associated with the improvements east of the project boundary to SW Regional Airport Boulevard and SW Rainbow Farm Road are included in the next section and more detailed cost estimates can be found in **Figure 5**.

Project Cost

Concept level construction cost estimates were developed for Alternative 2 and Alternative 4 using the average unit price summaries from similar projects. Detailed estimates are included in **Figure 5** and are summarized in the following table:

Construction Cost Summary							
	Α	lternative 2	A	Iternative 4			
Current Project							
Percentage Items	\$	473,198	\$	294,403			
Earthwork	\$	969,584	\$	785,839			
Roadway	\$	809,444	\$	1,375,988			
Bridge	\$	3,628,950	\$	1,202,775			
Contingency	\$	1,764,353	\$	1,097,702			
Subtotal Current (rounded)	\$	7,650,000	\$	4,760,000			
Future Extension							
Roadway	\$	5,940,000	\$	4,230,000			
Bridge			\$	2,100,000			
Subtotal Future	\$	5,940,000	\$	6,330,000			
Grand Total	\$	13,590,000	\$	11,090,000			

The concept level estimates are for construction cost only based on the concept design layouts.

The costs associated with future roadway connections to SW Rainbow Farm Road and SW Regional Airport Boulevard were calculated by per linear foot of anticipated length of construction to connect the new Opal Road alignment. These costs were determined using the unit rates for Alternative 2 and 4 and divided by the length to find an average cost per linear foot. A map with estimated construction costs for current and potential future improvements can be found below:



Figure B: Future Roadway Connections for Cost Estimates

The anticipated cost to connect Alternative 2 to SW Regional Airport Boulevard and reconstruct Vendor Boulevard to collector status would be approximately \$5.94 million. This accounts for the reconstruction of several horizontal curves to standard radii and reconstruction of Vendor Boulevard to a 3-lane section. A traffic signal cost is also included as the connection to SW Regional Airport Boulevard may meet signal warrants. Two different routes for the Vendor Boulevard connection were shown as possible connections and should be evaluated during design of this stretch. For the purpose of this report, the assumed cost for each of these two alternatives are the same dollar amount due to their similar length and nature.

For Alternative 4, the connection from the proposed Opal Road to SW Rainbow Farm Road would be approximately \$6.33 million. This connection would require a bridge over Little Osage Tributary #2 at SW Rainbow Farm Road at an estimated cost of \$2.10 million. This also assumes that the new portion of Opal Road and SW Rainbow Farm Road would be reconstructed to collector status and consist of a 3-lane section.

Conclusion

A comparison of the alternatives is summarized in the table below. The table compares the various criteria by assigning a value of fair, good, and best to each alternative to help compare and contrast each concept. Note Alternatives 1 and 3 were eliminated from consideration early in the analysis process in discussions with the City of Bentonville and by professional judgment.

	Alternatives								
Analysis Criteria	Alt 1	Alt 2	Alt 3	Alt 4					
Wetland	s		s						
Impacts	ysi		ysi						
Stream	nal		nal						
Channel	ng an	$ $ Θ	ອ ຜ						
Impacts	Lin I		Lin I						
Bridge	r consideration du		np						
Considerations		a consideration		ion					
Property			onsiderati	rati	rati	\cap			
Impacts				onside	ide	ide		ide	
Access During						suc			
Construction			-	Ŭ					
Future	Lou		Lon						
Roadway	d f	\square	d f						
Extensions	ate		ate						
Estimated	nin		nin						
Construction	Elir	0	Elir	\frown					
Cost									
● Best ⊖ Good	○ Fair								

Alternative 2 provides the shorter connection but has a longer bridge on a curve with more stream channel impacts. Alternative 2 will have fewer property impacts but will have a challenge to maintain access to the property south of the existing Opal Road bridge during construction. Alternative 2 will also have a higher estimated construction cost.

To address the challenges with Alternative 2, Alternative 4 was considered. Aside from property impacts, Alternative 4 meets the other criteria as well if not better than Alternative 2. When viewed from the perspective of providing an improved crossing of the floodplain only, Alternative 2 has a lower cost since the future extension needs to be considered as part of Alternative 4. When viewed from a long-term perspective, Alternative 4 with the future extension provides a more ideal connection with the transportation network by connecting to Rainbow Farm Rd, an arterial, allowing for better regional connectivity and possible future signalization with the intersection of SW Regional Airport Blvd (Highway 12). For these reasons, Alternative 4 is recommended.

FIGURE 1 Vicinity Map



FIGURE 2 Detailed Design Criteria

	Project H21-04210 - Opal Road					
			Design Criteria			
Roadway	Opal Road	Vendor Boulevard	Source - Primary	Source - Secondary		
Classification	Collector	Local Streets	MSP		Opal to be designed as	
Number of Traffic Lanes	3	2	MSP		Reference table 400-1	
Width of BOC to BOC	37'	31'	MSP		Reference table 400-1	
Number of Parking Lanes	0	0	MSP			
Bike Lane	0	0	MSP			
Width of Median	0	0	MSP			
Lighting	N/A	N/A	-			
Right-of-Way Width - Minimum	70'	50'	MSP		Reference table 400-1	
Design Speed	35 mph	25 mph	MSP		Reference table 400-1	
Posted Speed	30 mph	20 mph	MSP		Reference table 400-1	
Design Vehicle	WB-67	WB-67	-		With neighboring Waln	
AADT	1000 - 5000	< 1000	MSP		Reference table 400-1	
HORIZONTAL ALIGNMENT						
Stopping Site Distance	N/A	N/A	-			
Initersection Site Distance (ISD)	520'	260'	AASHTO - Ch 9.5.3.2		Values are unfactored.	
Roadway Cross-Slope	2%	2%	AASHTO - 4.2.2.1			
Superelevation eMax	N/A	N/A	-			
Minimum Radii Horizontal Curve	510'	198'	AASHTO 3.3.6 Table 3-13	MSP	Reference table 400-2	
Superelevation Runoff, L	N/A	N/A	-			
Percent Runoff Length Prior to Curve	N/A	N/A	-			
Minimum Tangent between Reverse Curves	100	100	MSP		Reference section 400	
Clear Zone	10'	7' - 10'	AASHTO RSDG			
Lateral Offset (Horizontal Clearance)	1.5'	1.5'	AASHTO - Section 6.2.4.2		Measured from face of	
			<u> </u>			
Minimum SSD Crest Vertical Curve	250'	155'	AASHTO 3.4.6.2 Table 3-35			
Minimum SSD Sag Vertical Curve	250'	155'	AASHTO 3.4.6.3 Table 3-37			
Maximum Grade	8%	8%	AASHTO 6.2.1.5 Table 6-2	MSP	Reference table 400-6	
Minimum Grade	1.0%	1.0%	BSS - Sec. 400.6	AASHTO 3.4.2.2.2		
Minimum K Crest Vertical Curve	29	12	AASHTO 3.4.6.2 Table 3-35	MSP	Reference table 400-4	
Minimum K Sag Vertical Curve	49	26	AASHTO 3.4.6.3 Table 3-37	MSP	Reference table 400-5	
Maximum K Type III Sag Vertical Curve-	167	167	AASHTO - 3.4.6 - Fig. 3-36		Max value to prevent p	
			<u> </u>			
Minimum Curb Return Radius	50'	25'	MSP		Reference table 500-8	
Taner Length		20	Mol		All tapers to follow AA	
Sidewalks	5' 12' sidenath	5' both sides	MSP		Reference table 400-1	
	7'		MSP		Reference table 400-1	
Foroslopo/Backelopo Maximum	1.2'	4				
Foreslope/Backslope - Maximum	1.3	1.3			Desirable clapse within	
	1.4	1.4	AASITTO KSDG		Desirable slopes within	
		sign Specifications Fighth F	lition with ourrent interime			
	11 minimum closerance to 4	00 year high water alayetis.				
		r for 100 year flows				
1	ino rise in bridge backwate	r for 100 year flows				

Notes
as collector with sidepath option to reduce width of section
)-1
)-1
)-1
)-1
)-1
almart Distribution Center, will be designed to WB-67
)-1
ed. Will need to account for an additional lane. See AASHTO
)-2
00.4.1 - Minimum Tangent Length
of curb.

-6, Use Local (Commercial/Industrial) for Vendor

-4

-5

t ponding from flat spots in sag vertical curves.

-8

ASHTO guidelines on transitions for less than 45 mph

-1

hin the clear zone = 4:1 or flatter

	Project H21-04210 - Opal Road							
	Design Criteria							
Roadway	Opal Road	Vendor Boulevard	Source - Primary	Source - Secondary				
REFERENCES				-				
AASHTO = A Policy on Geometric Design	of Highways and Streets - 2018	3 7th Edition						
MSP = Master Street Plan, City of Bentony	ville Standard Specifications for	Streets						
AASHTO RSDG = Roadside Design Guide	e 4th Edition 2011							

Notes

FIGURE 3

Roadway and Bridge Typical Sections





EXIST. GROUND





ALT 3 - OPAL ROAD (305+00 - 315+00)

							302 East Millsap Koad	Fayetteville, AR 72703 TEL 479.443.3404 www.olsson.com
FCO				F IC RY R BS				
BΥ								
REV. DATE REVISIONS DESCRIPTION								REVISIONS
								2021
FIGURE 4: ALTERNATE 3	PROFILE		OPAL ROAD IMPROVEMENTS					BENTONVILLE, AR
drawn l checke approv	by: _ d by: ed by:							
QA/QC by: ENG project no.: H21-04210 drawīn ⊈ X0+IBIT_ALT 3 H2104210 date: 11-16-2021								
)	S X	H	E of	E.	Т	Y		

FIGURE 5 Cost Estimates

Figure

Item

Client Name: Bentonville, Arkansas

Project Name: Opal Road Project Number: 021-04210-H

Figure 5: 0	Dpal Road - C	Dpinion of I	Probable C	ost
Alternative 2				

		olsson			
		Date	Index		
		11/16/2021			
Unit	Quantity	Unit Cost \$	Cost \$		
LS	1	\$108,159.57	\$108,159.		
LS	1	\$162,239.36	\$162,239.		

	Percentage Bid Items				
1	Insurance and Bonding @ 2%	LS	1	\$108,159.57	\$108,159.57
2	Mobilization @ 3%	LS	1	\$162,239.36	\$162,239.36
3	Temporary Traffic Control @ 0.5%	LS	1	\$27,039.89	\$27,039.89
4	Erosion and Sediment Control @ 1%	LS	1	\$54,079.79	\$54,079.79
5	Trench and Excavation Safety Systems @ 0.25%	LS	1	\$13,519.95	\$13,519.95
6	Clearing & Grubbing @ 0.5%	LS	1	\$27,039.89	\$27,039.89
7	Construction Staking @ 1%	LS	1	\$54,079.79	\$54,079.79
8	Demolition @ 0.5%	LS	1	\$27,039.89	\$27,039.89
		Subtotal			\$473,198.14
	Earthwork Bid Items				
9	Undercut and Backfill, complete in place	CY	4544	\$23.00	\$104,512.00
10	Excavation, complete in place	CY	7352	\$10.00	\$73,522.10
11	Embankment, complete in place	CY	25263	\$25.00	\$631,578.50
12	Subgrade Preparation, complete in place	SY	7881	\$1.75	\$13,791.75
13	Curb Backfill and Grading, complete in place	Sta.	36	\$750.00	\$27.000.00
14	Furnish and Place 4-inch Topsoil, complete in place	SY	9321	\$3.50	\$32.623.50
15	Sodding, complete in place	SY	2578	\$4 25	\$10,956,50
16	Retaining Wall, complete in place	SF	1260	\$60.00	\$75,600.00
		Subtotal			¢060 594 25
		Gubiotai	Τ		\$909,504.55
	Pavement, Curb, and Driveway Bid Items				
17	ACHM Surface Course, complete in place	TONS	818	\$120.00	\$98,160.00
18	ACHM Binder Course, complete in place	TONS	1636	\$120.00	\$196,320.00
19	6-inch Class 7 Aggregate Base Course, complete in place	SY	10694	\$11.00	\$117,634.00
20	Concrete Apron, complete in place	SY	89	\$55.00	\$4,895.00
21	Asphalt Driveway, complete in place	SY	449	\$42.50	\$19,082.50
22	Aggregate Base Course Driveway, complete in place	SY	449	\$12.00	\$5,388.00
23	Concrete Sidewalk (5' Wide), complete in place	SY	899	\$45.00	\$40,455.00
24	Concrete Trail (12' Wide), complete in place	SY	1914	\$45.00	\$86,130.00
25	Handicap Ramp, complete in place	EACH	2	\$765.00	\$1,530.00
26	Concrete Curb and Gutter (CG-1 Type A), complete in place	LF	3537	\$15.00	\$53,055.00
27	Strorm Drainage	LS	1	\$186,794.85	\$186,794.85
		Subtotal			\$809,444.35
	Pridra & Pridra Palatad Kama			1	
20	Bridge & Bridge Related Items	<u>ег</u>	10155	¢225 00	¢2 050 975 00
_∠0 20	Approach Slabs, complete in place	৫v	212	¢275.00	φ2,909,010.00 ¢50 575 00
30	Rock Blankets, complete in place	CY	1300	\$85.00	\$110 500 00
31	Channel Grading, TRM and Seeding, complete in place	18	1	\$500.000.00	\$500 000 00
<u> </u>	remaining, rran, and cooking, complete in place		1 .	<i>4000,000.00</i>	<i>4000,000.00</i>

Page 2 of 4

Subtotal \$3,628,950.00

	Subtotal A - deduct perce	\$5,407,978.70			
	Subtotal		\$5,881,177		
	Construction Contingency	30.0 %	\$1,764,353		
	Opinion of Probable Cost		\$7,650,000		
Design Status (Check One)					
X Conceptual Design					
Preliminary Design					
Final Design	UISSOI I				

The Engineer, using his or her professional judgement, has developed this stated Opinion of Probable Construction Cost based upon the design status identified above. Development of this Opinion has included consideration of design input level; however, the circumstances under which the work is expected to be undertaken, the cost and availability of materials, labor and services, probable bidder response and the economic conditions at the time of bid solicitation are beyond the control of the Engineer and will impact actual bid costs. Should bidding be delayed, these costs should be reviewed and, if necessary, adjusted to a more applicable Engineering News Record Construction Cost Index.

Notes:

1. Right-of-way, easements, or utilities (except water) have not been included in this estimate.

2. Engineering, surveying, or construction inspection have not been included in this estimate

Figure 5: Opal Road - Opinion of Probable Cost

Alternative 4

Client Name: Bentonville, Arkansas
Project Name: Opal Road
Project Number: 021-04210-H

	Item	Unit	Quantity	Unit Cost \$	Cost \$	
	Percentage Bid Items					
1	Insurance and Bonding @ 2%	LS	1	\$67,292.06	\$67,292.06	
2	Mobilization @ 3%	LS	1	\$100,938.09	\$100,938.09	
3	Temporary Traffic Control @ 0.5%	LS	1	\$16,823.02	\$16,823.02	
4	Erosion and Sediment Control @ 1%	LS	1	\$33,646.03	\$33,646.03	
5	Irench and Excavation Safety Systems @ 0.25%		1	\$8,411.51	\$8,411.51	
6	Clearing & Grubbing @ 0.5%	LS	1	\$16,823.02	\$16,823.02	
7		LS	1	\$33,646.03	\$33,646.03	
8	Demolition @ 0.5%	LS	1	\$16,823.02	\$16,823.02	
		Subtotal		I	\$294,402.78	
	For the set D' d House					
	Earthwork Bid Items					
9	Undercut and Backfill, complete in place	CY	7393	\$23.00	\$170,039.00	
10	Excavation, complete in place	CY	4493	\$10.00	\$44,928.00	
11	Embankment, complete in place	CY	18062	\$25.00	\$451,542.00	
12	Subgrade Preparation, complete in place	SY	13388	\$1.75	\$23,429.00	
13	Curb Backfill and Grading, complete in place	Sta.	65	\$750.00	\$48,750.00	
14	Furnish and Place 4-inch Topsoil, complete in place	SY	6333	\$3.50	\$22,165.50	
15	Sodding, complete in place	SY	5879	\$4.25	\$24,985.75	
		Subtotal		I	\$785,839.25	
	Bayement Curb and Driveway Bid Items					
16	ACHM Surface Course, complete in place	TONS	1331	\$120.00	¢150 720 00	
17	ACHM Binder Course, complete in place	TONS	2662	\$120.00	\$319 440 00	
18	6-inch Class 7 Aggregate Base Course, complete in place	SY	18971	\$11.00	\$208 681 00	
19	Concrete Apron, complete in place	SY	186	\$55.00	\$10,230,00	
20	Asphalt Driveway, complete in place	SY	176	\$42.50	\$7,480.00	
21	Aggregate Base Course Driveway, complete in place	SY	176	\$12.00	\$2,112.00	
22	Concrete Sidewalk (5' Wide), complete in place	SY	1998	\$45.00	\$89.910.00	
23	Concrete Trail (12' Wide), complete in place	SY	3586	\$45.00	\$161.370.00	
24	Handicap Ramp, complete in place	EACH	4	\$765.00	\$3.060.00	
25	Concrete Curb and Gutter (CG-1 Type A), complete in place	LF	6430	\$15.00	\$96,450.00	
26	Storm Drainage	LS	1	\$317,535.90	\$317,535.90	
		Subtotal			\$1,375,988.90	
	Opal Road - Bridge & Bridge Related Items					
27	Bridge, complete in place	SF	5980	\$165.00	\$986,700.00	
28	Approach Slabs, complete in place	SY	213	\$275.00	\$58,575.00	
29	Rock Blankets, complete in place		500	\$85.00	\$42,500.00	
30		L3	I	\$115,000.00	\$115,000.00	
		Subtotal			\$1,202,775.00	
					·····	
	Subtotal	A - deduct per	cent items		\$3,364,603.15	
Subtotal						
Construction Contingency 30.0 %						
Design Status (Check One)						
X	Conceptual Design					
1	Preliminary Design		000			
	Final Design		133			

Page 4 of 4

Index

olsson

Date

11/16/2021

The Engineer, using his or her professional judgement, has developed this stated Opinion of Probable Construction Cost based upon the design status identified above. Development of this Opinion has included consideration of design input level; however, the circumstances under which the work is expected to be undertaken, the cost and availability of materials, labor and services, probable bidder response and the economic conditions at the time of bid solicitation are beyond the control of the Engineer and will impact actual bid costs. Should bidding be delayed, these costs should be reviewed and, if necessary, adjusted to a more applicable *Engineering News Record* Construction Cost Index.

Notes:

1. Right-of-way, easements, or utilities (except water) have not been included in this estimate.

2. Engineering, surveying, or construction inspection have not been included in this estimate

FIGURE 6 HEC-RAS Results

Existing Conditions Alternative 2 Opal Road

Proposed Conditions Alternative 2 Opal Road

Existing Conditions Alternative 4 Opal Road

Proposed Conditions Alternative 4 Opal Road

Existing Conditions Alternative 4 Rainbow Road

Proposed Conditions Alternative 4 Rainbow Road

